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7590

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EXAMINER

DOAN, THERESA T

ART UNIT

PAPER NUMBER

2814

DATE MAILED: 05/08/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/992,458

Applicant(s)

SHIH ET AL.

Examiner

Theresa T Doan

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 16 November 2001.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

**DETAILED ACTION**

***Claim Rejections - 35 USC § 102***

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or

(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

2. Claims 1, 4, 16-17 and 19 are rejected under 35 U.S.C. 102(e) as being anticipated by Alers et al. (6,320,244).

Alers et al. teach in figures 6-9 a method for making a metal-insulator-metal capacitor on a substrate 30 comprising the steps of:

forming bottom electrode 44 from a first conducting layer on the substrate;

depositing a first wide-band-gap insulating layer 64 on the bottom electrode;

depositing a multi-layer of high-k dielectric film 66 over the wideband-gap insulating layer;

depositing a second wide-band-gap insulating layer 68 over the multi-layer;

forming top electrode 48 from a second conducting layer on the second wide-band-gap insulating layer (figure 9).

Regarding claims 4 and 19, Alers et al. teach the high-k dielectric film is a material selected from the group that includes tantalum pentoxide (figure 9, column 5, lines 12-13 and column 1, lines 43-46).

Regarding claim 17, Alers et al. teach the bottom electrode and the top electrode are made of the group that includes titanium nitride (figure 9, column 4, lines 48-50 and column 5, lines 15-16).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 2-3, 5-15, 18 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alers et al. (6,320,244) in view of Yoon et al. (5,688,724).

Regarding claims 2-3, 10 and 12, Alers et al. teach in figures 6-9 a method for making a metal-insulator-metal capacitor on a substrate 30 comprising the steps of:

forming bottom electrode 44 that composed of titanium nitride on the substrate (column 4, lines 48-50);

depositing a first  $\text{TiO}_2$  wide -band-gap insulating layer 64 on the bottom electrode (column 7, lines 29-32);

depositing a tantalum pentoxide high-k dielectric film 66 over the wideband-gap

insulating layer (figure 9, column 5, lines 12-13 and column 1, lines 43-46);

depositing a second  $\text{TiO}_2$  wide-band-gap insulating layer 68 over the high-k dielectric film (column 7, lines 35-39);

forming top electrode 48 that composed of titanium nitride over the second wide-band-gap insulating layer (figure 9, column 5, lines 15-16).

Alers et al. do not teach an aluminum oxide of first and second wide-band-gap insulating layers. However, Yoon et al. teach in figure 21 the material of dielectric layers includes  $\text{SiO}_2$ ,  $\text{TiO}_2$ ,  $\text{Si}_3\text{N}_4$  and  $\text{Al}_2\text{O}_3$  (column 11, lines 12-15). Therefore, it would have been obvious to substitute  $\text{Al}_2\text{O}_3$  insulating layer for  $\text{TiO}_2$  insulating layer in Alers et al. Because the substitution of art recognized equivalent as suggested by Yoon et al. is within the level of ordinary skill in the art.

Regarding claims 2, 11 and 18, It would have been obvious to a person of ordinary skill in the art at the time the invention was made to deposit a thickness of the bottom electrodes and the top electrodes that between 200 and 1000 Angstroms in Alers's device, since it is a matter of design choice within the skills of an artisan, subject to routine experimentation and optimization.

Regarding claims 5-7 and 14, it is well known that the high-k dielectric film is deposited by methods of physical vapor deposition, chemical vapor deposition and atomic layer chemical vapor deposition as taught by Alers and Yoon in order to operate the device in its intended use.

Regarding claims 8 and 13, It would have been obvious to a person of ordinary skill in the art at the time the invention was made to deposit a thickness of the high-k dielectric film that about 50 and 800 Angstroms in Alers's device, since it is a matter of design choice within the skills of an artisan, subject to routine experimentation and optimization.

Regarding claims 9, 15 and 20, Alers et al. teach substantially the entire claimed structure, as applied to claims 1, 10 and 16 above, except for the high-k dielectric film is treated in a gas selected from the group that includes oxygen, nitrogen, nitrous oxide, and ammonia, and rapid thermally annealed at a temperature of between about 300 and 700°C for a time of between about 1 and 260 seconds.

Yoon et al. teach a high-k dielectric film 14 is treated in a gas selected from the group that includes oxygen and rapid thermally annealed at a temperature of between about 400-550°C for a time of five minutes (column 4, lines 19-25) in order to reduce leakage current in a dielectric structure. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to modify the Alers et al. structure using the method of Yoon for the reason shown.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Theresa T Doan whose telephone number is (703) 305-2366. The examiner can normally be reached on 8:00AM - 6:00PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, OLIK CHAUDHURI can be reached on (703) 308-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

TD  
May 2, 2002



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